

PATENT CLAIMS

1. A turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) for clamping concrete shell elements (1, 2), having two claws (15a, 15b, 15c, 16a, 16b, 16c; 21, 22) and a wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c), the claws (15a, 15b, 15c, 16a, 16b, 16c; 21, 22) being displaceable toward one another in a clamping direction (34), the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) being guided in the clamping device along a wedge guiding direction (33), and the dimension of the propulsion of the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) in the turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) determining the displacement of the claws (15a, 15b, 15c, 16a, 16b, 16c; 21, 22), characterized in that the wedge guiding direction (33) and the clamping direction (34) enclose an angle  $\alpha$  less than  $90^\circ$ .
2. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to Claim 1, characterized in that the angle  $\alpha$  is between  $40^\circ$  and  $85^\circ$ , particularly approximately  $70^\circ$ .
3. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to Claim 2, characterized in that the angle  $\alpha$  is approximately  $45^\circ$ .
4. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims, characterized in that the following relationship applies for the angle  $\alpha$ :  
$$\alpha \leq 90^\circ - \arctan (B/L),$$

with L: length of the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) in the wedge guiding direction (33), and B: greatest width of the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) measured transversely to the wedge guiding direction (33) and in the plane of the wedge guiding direction (33) and clamping direction (34).

5. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims,  
characterized in that the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) is solely guided by one of the claws (22).
6. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims,  
characterized in that the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) has at least one depression and/or protrusion, which runs diagonally to the wedge guiding direction (33), and at least one of the claws (15a, 15b, 15c; 21) has a profile which engages in the depression and/or protrusion of the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c).
7. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims,  
characterized in that the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) has a cross-section tapering along the wedge guiding direction (33).
8. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to Claim 6,

characterized in that the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) has a constant size along the wedge guiding direction (33).

9. The turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims,

characterized in that the turnbuckle device (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) may be positioned for mounting on internal joint corners or external joint corners or perpendicular outer corners of concrete shell elements (1, 2).

10. A concrete shell system, comprising concrete shell elements (1, 2) and turnbuckle devices (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) according to one of the preceding claims,

the concrete shell elements (1, 2) each having multiple mounting positions, particularly struts, for the turnbuckle devices (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c),

the mounting positions being spaced apart at an interval A from one another in a direction perpendicular to the clamping direction (34) of the turnbuckle devices (12, 13, 14; 20; 35a, 35b, 35c; 44a, 44b, 44c) to be mounted on the mounting positions,

characterized in that the following relationship applies for the angle:

$$\alpha \leq 90^\circ - \arctan (B/A),$$

with B: greatest width of the wedge (17a, 17b, 17c; 23; 37a, 37b, 37c; 46a, 46b, 46c) measured transversely to the wedge guiding direction (33) and in the plane of wedge guiding direction (33) and clamping direction (34).